



The John Snow Project

An Open Letter to Healthcare Providers

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Dear Colleague

The John Snow Project is paid for and run by volunteers, many of whom are frontline healthcare workers who've cared for patients throughout the pandemic. Free of political interference or funding conflicts, the objective of the organization is to provide impartial expert analysis of public health policy and the science behind the SARS-CoV-2 pandemic.

The John Snow Project believes there is now overwhelming evidence to support the mandatory use of respirator masks as a minimum standard in all healthcare settings. Our evidence focuses on respirator masks, but we also encourage the use of clean air and effective staff isolation policies to minimize the spread of infection in line with the Delphi Consensus and vaccines-plus recommendations to address the challenges of the pandemic ^{1,2}.

1. DO NO HARM

In healthcare ethics there is no debate over whether we want to avoid doing harm to patients, staff, or the community ³. Nonmaleficence or "do no harm" is an established principle of healthcare provision, so it is perplexing to even be writing a letter arguing for the implementation of practices that are highly effective against all respiratory infections, but particularly against SARS-CoV-2, which causes a high degree of harm to patients when acquired in healthcare settings due to their immune or health status ⁴⁻⁸.

2. PROTECTION FROM INFECTION IS NOT ASSURED

In the early days of the pandemic, some commentators assumed herd immunity would be achievable against SARS-CoV-2. Members of the John Snow Project called out this fallacy from day one, and subsequent events proved them correct. SARS-CoV-2 didn't disappear and is still spreading.

even though most people have been infected at least once, and many more than once. It is important to understand that healthcare infection control policies are currently being decided as if herd immunity were a feasible strategy. This is a grave mistake.

Herd or community immunity is used to define a state in which the majority of a population are protected from infection by prior vaccination or infection. This means the minority of the population who cannot achieve vaccine- or infection-induced immunity, predominantly the immunocompromised and infants, are protected by virtue of the relevant pathogen having a limited number of hosts to infect in the general population. In this scenario, the exposure risk for the unprotected members of the population is greatly reduced^{9,10}.

Herd immunity has not been achieved with SARS-CoV-2, and background prevalence is so high that people face regular exposure¹¹, particularly in settings where lots of people congregate, such as hospitals, which also, by their very nature, concentrate vulnerable and infectious individuals in one place. Surging waves of infection increase the levels of transmission, raising the risk beyond the baseline every few months.

When it became clear that herd immunity would be unattainable with SARS-CoV-2, some commentators switched to the concept of so-called hybrid immunity: protection through a combination of vaccination and infection. But this so-called hybrid immunity has also turned out to be an illusion as now shown by the compelling evidence presented in a recent study¹² in which participants who ostensibly had immunity against one Omicron variant were at greater risk of reinfection by another variant.

Neither previous infection with the original wild type (WT) virus, nor multiple infections with WT, other variants and/or Omicron provide reliable protection against reinfection.

We should also remember that viral evolution has not stopped and an entirely new serotype of SARS-CoV-2 might appear at any time, strongly

evading immunity. The recent detection of the extremely divergent BA.2.86 variant may or may not represent such an event, but even if it fizzles out on its own, it is a stark warning about this ever-present risk. With reduced surveillance, we should not assume a new serotype will be detected before it has spread widely into the community and healthcare systems.

Both vaccines and previous infections have failed to provide either herd or so-called hybrid immunity, so neither concept should be used to inform infection control policy in any setting.

3. HIGH EXPOSURE SETTINGS CARRY AN INHERENT INFECTION RISK

A recent study of an incarcerated population shows that even in the context of prior vaccine- or infection-induced immunity to the same circulating variant, such protection can be overcome by high exposure¹³. Subjects who had infection-induced, vaccine-induced and so-called hybrid immunity were reinfected in high exposure settings, suggesting inoculum dose matters. This is not a new concept and has been considered before in relation to both SARS-CoV-2 as well as other pathogens¹⁴.

This high exposure phenomenon is particularly relevant to patients and staff in healthcare settings, where they may be working on or sharing wards with people who emit large quantities of SARS-CoV-2. The UK human challenge study demonstrated that a minority of people emit a much higher than average amount of virus when infected^{15,16}, and all it takes is one such person to be in a hospital setting to greatly increase the exposure risk for everyone.

In the age of Omicron, in the context of high community prevalence and rapidly evolving sub-variants that can evade immunity, it seems particularly reckless to rely on vaccine or prior infection acquired immunity as the only mechanism of protection against infection, particularly in high exposure settings where sufficient inoculum dose can even overcome prior immunity from the same variant.

4. HOSPITAL INFECTION IS MORE HAZARDOUS THAN COMMUNITY INFECTION

Many have fallen victim to the propaganda that Omicron is mild. Vaccines and infection-acquired immunity have reduced the acute risk of death or hospitalization, but each and every SARS-CoV-2 infection still represents a serious health risk, and can be a matter of life or death for the, by definition, highly vulnerable already hospitalized populations or people who are frequent healthcare users. For example, SARS-CoV-2 infection in people with systemic lupus erythematosus results in a much higher risk of serious illness or death than in the general population^{17,18}. The same is true of people with cancer^{19,20} and the immunocompromised^{21,22}. Even when highly vaccinated, elderly people still face a high risk of severe outcomes, including death. Highly vaccinated octogenarians residing in nursing homes have been shown to still face a mortality risk of 17% from SARS-CoV-2 infection²³. These are people who are likely to require healthcare provision more frequently than the general population, so it is perplexing to expect them to face a very real and increased risk of serious harm every time they seek care⁴⁻⁸.

Studies from around the world have shown that mortality associated with hospital acquired COVID-19 ranges from 6-10% even in the Omicron era⁴⁻⁸, a much higher mortality rate than cases where COVID-19 was acquired in the community, and several fold higher than mortality related to drug resistant nosocomial pathogens for which hospitals routinely initiate infection control protocols. Exposing patients to a pathogen associated with such high mortality within hospitals is unacceptable. The airborne nature of SARS-CoV-2²⁴⁻²⁶ also means that infection spreads easily within healthcare facilities, as evidenced by the high burden of nosocomial infection seen across hospitals in several countries⁶⁻⁸.

5. ALL INFECTIONS REPRESENT A PUBLIC HEALTH RISK TO

PATIENTS AND STAFF

While vaccination and prior infection seem to reduce the risk of developing Long COVID, they do not eliminate it, which means there is an unacceptable risk in day-to-day life of an infection that might cause serious consequences. Given the potentially long-term debilitating effects of Long COVID, our lack of understanding of what drives the condition, and the complete absence of any guarantees that effective treatments for it will be discovered, it represents a significant public health risk to everyone^{[27-29](#)}. Studies show the risk of Long COVID is considerably higher among those with pre-existing conditions, a group most likely to require more frequent care in hospitals^{[30](#)}. The risk of Long COVID isn't simply an issue for patients, it is also becoming a significant issue for healthcare workers^{[31-31](#)}. Even if one ignores the heightened risk hospital acquired infection poses for patients, reducing acute and long-term illness in healthcare workers is sufficient rationale for better infection control policies.

6. RESPIRATORS ARE EFFECTIVE AT PREVENTING INFECTION

In 2013, the US CDC established that surgical masks are not effective protection against respiratory infection^{[34](#)}. A 2013 randomized clinical trial of N95 respirators in healthcare settings showed that continuous use of N95 respirators was highly effective at preventing infection^{[35](#)}. Donning and doffing masks in the presence of patients was not, which is exactly what one would expect when dealing with airborne respiratory pathogens. Research for the UK Health & Safety Executive showed at least a 100-fold reduction in influenza bioaerosol exposure when wearing a properly fitted respirator, compared with a 6-fold reduction when wearing a surgical mask^{[36](#)}. More recent studies have shown N95/FFP2 or better masks are highly effective at preventing SARS-CoV-2 infection^{[37-41](#)}. Wearing respirators protects healthcare workers and patients.

Effective airborne precautions have been the standard for decades when working with BSL 3/4 agents in laboratory settings. It is mystifying that these long established standards are now being abandoned when the life

these long established standards are now being abandoned when the life and health of actual patients and wellbeing of healthcare workers are at stake.

7. HEALTHCARE PROVIDERS NEED TO MEET MINIMUM STANDARDS

Public health agencies around the world recommend the use of multi-layered protections against COVID-19 and Long COVID⁴². It would seem to be a fundamental rejection of the principle of "do no harm" for hospitals to apply lower standards of infection control than public health agencies advise the general public to use in their day to day lives.

We believe there is no reasonable argument against the use of respirator masks in healthcare settings. The arguments against their use seem to center on comfort or cost, neither of which have previously been acceptable reasons for a reduction in the standard of care offered to patients or the duty of care owed to staff and patients.

We hope you will raise this issue with the person or people responsible for infection prevention in your organization and that you will join us in our campaign to ensure that healthcare workers are not exposed to unnecessary occupational hazard, and that patients receive the best possible care while facing the lowest possible risk of an infection that could shorten or fundamentally alter their lives.

Yours faithfully

The John Snow Project
johnsnowproject.org

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References

1. Covid-19: An urgent call for global “vaccines-plus” action
<https://www.bmj.com/content/376/bmj.o1>
2. A multinational Delphi consensus to end the COVID-19 public health threat
<https://www.nature.com/articles/s41586-022-05398-2>
3. Principles of Healthcare Ethics
http://samples.jbpub.com/9781284124910/9781284124910_CH02_OnlineCat.pdf
4. Clinical Outcome and Prognosis of a Nosocomial Outbreak of COVID-19
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10056618/>
5. Hundreds die of COVID after catching virus while in hospital
<https://www.theage.com.au/national/victoria/hundreds-die-of-covid-after-catching-virus-while-in-hospital-20230330-p5cwjx.html>
6. Nosocomial COVID-19: A Nationwide Spanish Study
<https://karger.com/ger/article/69/6/671/836268/Nosocomial-COVID-19-A-Nationwide-Spanish-Study>
7. Public Health Wales Briefing: All-cause mortality in nosocomial COVID-19 cases in Wales
<https://phw.nhs.wales/services-and-teams/harp/nosocomial-covid-briefing-reports/all-cause-mortality-in-nosocomial-covid-19-cases-in-wales-version-12/>
8. Transmission dynamics and associated mortality of nosocomial COVID-19 throughout 2021: a retrospective study at a large teaching hospital in London
[https://www.journalofhospitalinfection.com/article/S0195-6701\(23\)00002-6/fulltext#%20](https://www.journalofhospitalinfection.com/article/S0195-6701(23)00002-6/fulltext#%20)
9. US CDC: Community Immunity
<https://www.cdc.gov/vaccines/terms/glossary.html#commimmunity>
10. US CDC: Immunization: The Basics
<https://www.cdc.gov/vaccines/vac-gen/imz-basics.htm>
11. The relative prevalence of the Omicron variant within SARS-CoV-2 infected cohorts in different countries: A systematic review
<https://www.tandfonline.com/doi/full/10.1080/21645515.2023.2212568>
12. Early Omicron infection is associated with increased reinfection risk in older adults in long-term care and retirement facilities
[https://www.thelancet.com/journals/eclinm/article/PIIS2589-5370\(23\)00325-5/fulltext](https://www.thelancet.com/journals/eclinm/article/PIIS2589-5370(23)00325-5/fulltext)

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The John Snow Project invites healthcare workers, patients and community advocates to send this letter to their local healthcare provider to encourage the reintroduction of multi-layered mitigations to protect patients from the serious impacts of SARS-CoV-2 infection and COVID-19.

Recipients might include:

- Your Primary Care Provider/General Practitioner (GP)
- The Chief Executive of your local hospital
- The Infection Prevention and Control team at your local hospital
- Your local dentist
- Your national health service Infection Prevention and Control team
- Your national standards agency (Quality Care Commission, National Institutes of Health, Center for Disease Control, etc)
- Your local health and safety agency

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